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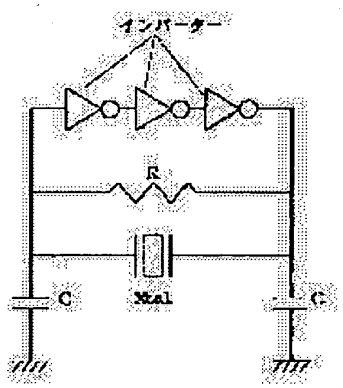
(54) CRYSTAL OSCILLATION CIRCUIT FOR LIQUID SENSOR

(57)Abstract:
PROBLEM TO BE SOLVED: To allow a negative resistor for a crystal oscillation circuit to be set at a sufficiently large value and to ensure stable oscillation in a liquid by using an odd number of amplifiers and a feedback circuit including a liquid crystal sensor.
SOLUTION: When a crystal resonator in an oscillation circuit is used as a liquid sensor, the resonator is soaked in a liquid and changes in frequency are measured under each condition. In a liquid, effective resistance of the crystal resonator is about ≥20 times as much as that measured in the air. Thereby, stable oscillation is difficult to be attained in the oscillation circuit. Thus, in order to improve amplification ratio of an amplifier, an odd number of amplifiers are connected in series to secure sufficiently large negative resistance of the oscillation circuit. Thus, stable frequency is supplied. An amplifier circuit uses three IC inverters and connected in series to obtain a liquid sensor having satisfactory oscillation intensity and also to attain negative resistance of the oscillation circuit up to about −3 kΩ to −5 kΩ.



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CLAIMS

[Claim(s)]

[Claim 1] A ridge oscillator for liquid sensors constituted from a feedback circuit containing two or more odd amplifier and Xtal sensors for liquids.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the oscillator circuit which makes stability oscillate the Xtal sensor in a liquid.

[0002]

[Description of the Prior Art] The oscillator circuit using the conventional quartz resonator has long history, many stable oscillator circuits are developed, and the actual condition is put in practical use. In order that the quartz resonator used for these may prevent secular change, it is put into a metal vessel etc. and is performing vacuum **** or inert gas ****. When a place uses a quartz resonator as a liquid sensor in the case of the theme, the main part of a quartz resonator is dipped in a liquid, and the object measures change of the frequency under a monograph affair. In this case, if the effective resistance of a quartz resonator compares the inside of air and a liquid, the effective-resistance value in a liquid will become about 20 or more times of the effective-resistance value in air. Generally, a quartz resonator can be expressed as an electrical equivalent circuit, and shows the symbol and electrical equivalent circuit of a quartz resonator to drawing 3 . R1 shown here is the electric effective-resistance value of a quartz resonator, and this value will increase in a liquid. Therefore, in the conventional ridge oscillator, the stable oscillation is very difficult.

[0003]

[Problem(s) to be Solved by the Invention] When the conventional oscillator circuit is used, just as it dips a quartz resonator (for sensors) into a liquid, it is a usual state that it is quenched. This invention solves the above defect and offers the oscillator circuit which performs an oscillation stable as a liquid sensor.

[0004]

[Means for Solving the Problem] The conventional ridge oscillator is a basic circuit where what is shown in drawing 4 and drawing 5 is common. Since the effective-resistance value is very large in the case of a liquid sensor, an oscillation is difficult in this kind of oscillator circuit. Therefore, in order to raise amplification degree of amplifier, two or more odd amplifier was connected to a serial. Generally, if an input of a feedback circuit does not have phase rotation about 180 degrees in drawing 4 and a basic circuit of drawing 5 , since a theory top is impossible for an oscillation, in this type of circuit, an oscillation is impossible in even amplifying circuits. Therefore, in this invention, it considered as odd amplifier. A feedback circuit containing a quartz resonator was connected to this amplifying circuit, an oscillator circuit was constituted, and a ridge oscillator for liquid sensors with sufficient oscillation reinforcement

was completed.

[0005]

[Function] Although the negative resistance of the oscillator circuit which can oscillate the conventional oscillator circuit and which was seen from the quartz-resonator side had -200ohms - common -300 ohms, the negative resistance of the oscillator circuit of this invention has been enough checked even in -3kohm--5k ohm. Therefore, this circuit is a circuit which can supply frequency stable enough as an object for liquid sensors.

[0006]

[Example] Drawing 1 is the example 1 of the oscillator circuit for liquid sensors of this invention. The amplifying circuit of this circuit connects three inverters to a serial using the IC-ized inverter. Drawing 2 is the example 2 of the oscillator circuit for liquid sensors of this invention. The amplifying circuit of this circuit is an oscillator circuit of the three-step amplification which used the transistor. In addition, as for the quartz resonator for liquid sensors used in this example, it is natural that the electrode of one of the two of a vibrator electrode is insulated thoroughly.

[007]

[Effect of the Invention] Although it was very difficult in the conventional ridge oscillator to drive the Xtal sensor in a liquid, if the oscillator circuit of this invention is used, the negative resistance of an oscillator circuit can also be designed greatly enough, and an oscillation sufficiently stable also in a liquid is possible for it.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The basic circuit of the example 1 of this invention is shown.

[Drawing 2] The basic circuit of the example 2 of this invention is shown.

[Drawing 3] The symbol and electrical equivalent circuit of a common quartz resonator are shown.

[Drawing 4] The Colpitts oscillator circuit which is a basic circuit of a ridge oscillator is shown.

[Drawing 5] The Hartley oscillator circuit which is a basic circuit of a ridge oscillator is shown.

[Description of Notations]

Xtal: Quartz resonator

R : resistance

L : inductance

C : electrostatic capacity

Tr : transistor

R1 : Equivalence effective resistance of a quartz resonator

C1 : Equivalence electrostatic capacity of a quartz resonator

L1 : Equivalence inductance of a quartz resonator

C0 : Interelectrode capacity of a quartz resonator

[Translation done.]

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審査請求　未請求　請求項の数１　書面　（全　３　頁）

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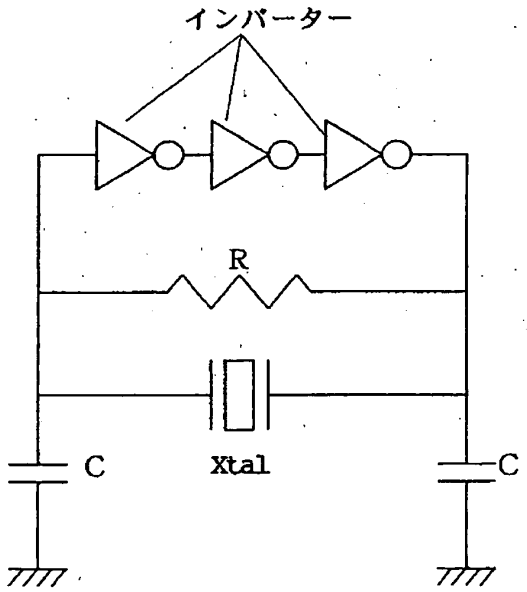
(54)【発明の名称】　液体センサー用水晶発振回路

(57)【要約】

【目的】従来の水晶発振回路では、液体センサーとしての水晶振動子を発振させるのは極めて困難又は不可能であった。水晶振動子を液体に浸しても安定な発振が継続できる発振回路を提供するのが目的である。

【構成】発振回路は増幅器と帰還回路により構成されるのが基本原理であるから、本発明は、増幅回路の増幅を上げる方法として、帰還回路の位相関係も考慮して、複数奇数個の増幅回路と帰還回路から構成するものとした。



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【特許請求の範囲】

【請求項１】　複数奇数個の増幅器と液体用水晶センサーを含む帰還回路から構成する液体センサー用水晶発振回路。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は液体中で水晶センサーを安定に発振させる発振回路に関する。

【０００２】

【従来の技術】従来の水晶振動子を用いた発振回路は、長い歴史を持ち、数々の安定な発振回路が開発され、実用化されているのが現状である。これらに用いられる水晶振動子は経年変化を防止するため、金属容器等に入れ真空封じ又は不活性ガス封じを行っている。所が、主題の場合、水晶振動子を液体センサーとして用いる場合は、水晶振動子本体を液体に浸し各条件の下での周波数の変化を測定するのが目的である。この場合水晶振動子の実効抵抗は、空気中と液体中を比較すると、液体中の実効抵抗値は空気中の実効抵抗値の約２０倍以上になる。一般に、水晶振動子は電気的等価回路として表わすことが可能であり、図３に水晶振動子のシンボルと電気的等価回路を示す。ここで示すＲ１が水晶振動子の電気的な実効抵抗値であり、液体中では、この値が増大することになる。従って、従来の水晶発振回路では安定な発振は極めて困難である。

【０００３】

【発明が解決しようとする課題】従来の発振回路を用いると、水晶振動子（センサー用）を液体中に浸した途端に発振停止となるのが常である。本発明は以上の欠点を解決し、液体センサーとして安定な発振を行う発振回路を提供するものである。

【０００４】

【課題を解決するための手段】従来の水晶発振回路は、図４、図５にしめすものが一般的な基本回路である。液体センサーの場合は、実効抵抗値が極めて大きいので、この種の発振回路では発振は困難である。そのため増幅器の増幅度を上げるため、複数奇数個の増幅器を直列に接続した。一般に、図４、図５の基本回路では帰還回路の入力は１８０度位相回転が無ければ発振は理論上不可能であるから、この回路形式では、偶数個の増幅回路では発振は不能である。従って本発明では奇数個の増幅器とした。この増幅回路に水晶振動子を含む帰還回路を接続し発振回路を構成し、充分な発振強度を持つ液体センサー用水晶発振回路を完成させた。

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【０００５】

【作用】従来の発振回路の発振可能な、水晶振動子側から見た発振回路の負性抵抗は－２００Ω～－３００Ωが一般的であるが、本発明の発振回路の負性抵抗は－３ｋΩ～－５ｋΩ位までは充分確認出来た。従って、本回路は液体センサー用として充分に安定な周波数を供給出来る回路である。

【０００６】

【実施例】図１が本発明の液体センサー用発振回路の実施例１である。この回路の増幅回路は、ＩＣ化されたインバーターを用いたものであり、インバーター３個を直列に接続したものである。図２が本発明の液体センサー用発振回路の実施例２である。この回路の増幅回路は、トランジスターを用いた、３段増幅の発振回路である。尚、この実施例で用いた液体センサー用水晶振動子は振動子電極の片方の電極は完全に絶縁されたものであることは当然である。

【００７】

【発明の効果】従来の水晶発振回路では、液体中の水晶センサーを駆動するのは極めて困難であったが、本発明の発振回路を使用すれば、発振回路の負性抵抗も充分に大きく設計することが可能であり、液体中でも充分安定な発振が可能である。

【図面の簡単な説明】

【図１】本発明の実施例１の基本回路を示す。

【図２】本発明の実施例２の基本回路を示す。

【図３】一般の水晶振動子のシンボルと電気的等価回路を示す。

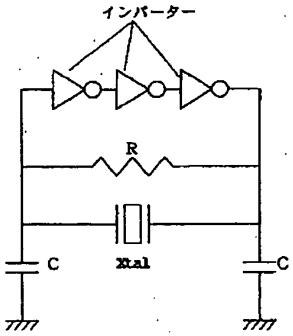
【図４】水晶発振回路の基本回路である、コルピッツ発振回路を示す。

【図５】水晶発振回路の基本回路である、ハートレイ発振回路を示す。

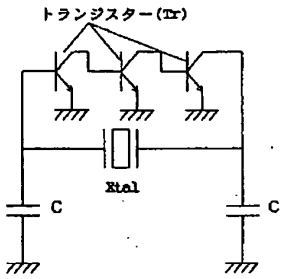
【符号の説明】

Ｘｔａｌ：水晶振動子
Ｒ　　：抵抗
Ｌ　　：インダクタンス
Ｃ　　：静電容量
Ｔｒ　：トランジスター
Ｒ１　：水晶振動子の等価実効抵抗
Ｃ１　：水晶振動子の等価静電容量
Ｌ１　：水晶振動子の等価インダクタンス
Ｃ０　：水晶振動子の電極間容量

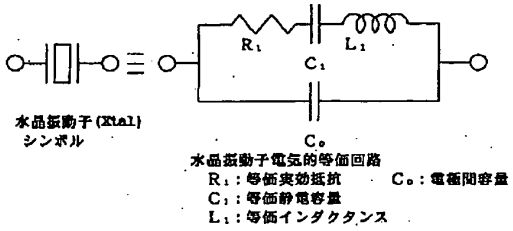
【図１】


インバーター
R
C
Xtal
C

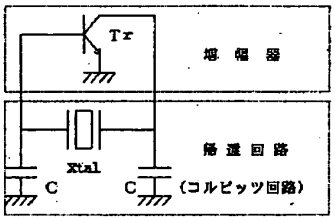
【図２】


トランジスター(Tr)
Xtal
C
C

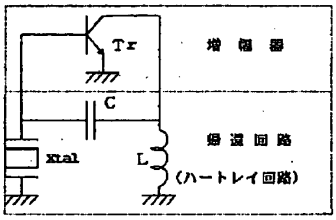
【図３】


R₁
L₁
C₁
C₀
水晶振動子(Xtal)
シンボル
水晶振動子電気的等価回路
R₁：等価実効抵抗　　C₀：電極間容量
C₁：等価静電容量
L₁：等価インダクタンス

【図４】


Tr
増幅器
帰還回路
Xtal
C
C
(コルピッツ回路)

【図５】


Tr
増幅器
C
帰還回路
Xtal
L
(ハートレイ回路)

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